PRESS BULLETIN 558 *March, 1941*

IMPERIAL AGRICULTURAL INSTITUTE 22 SEPT. 1941

UNIVERSITY OF FLORIDA
AGRICULTURAL EXPERIMENT STATION
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GAINESVILLE

LEAF BLISTER OF OAKS

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Leaf blister of oaks in Florida is caused by the parasitic fungus *Taphrina coerulescens* (D. & M.) Tul. Although affected trees are seldom killed by the disease, they frequently suffer actual stunting from the loss of leaves and energy required to produce new ones. When trees are heavily infected they are seriously damaged and present an unsightly appearance, the ones used for street and private plantings being especially noticeable. Leaf blister is found on oaks to some extent in Europe and North America. In the United States its distribution is general throughout the Great Plains and it has been observed in almost every state. More than a score of species of oaks have been found infected.

Its occurrence and importance in most sections of the country are variable and erratic, except in the Gulf and South Atlantic States. In this area it causes light to heavy infections on the leaves every year. There is considerable variability in the amount of disease appearing on species of oaks over a series of years or even on a single species during any single year when extensive geographical range is considered. A certain tree may suffer several years in succession to the extent of complete loss of the spring crop of leaves and then a year may follow during which no trace of the disease can be observed. No satisfactory explanation is available to account for this phenomenon. In Florida, the water, laurel, live, turkey and red oaks and various hybrids are most commonly infected.

The disease has been found only on the foliage which almost without exception is attacked only once during the year. The question frequqently asked is: "Where does the fungus survive from year to year?" Shed leaves carry the infected host tissue from the tree to the soil. There is no perennial mycelium remaining in any parts of the aerial host tissue. It is often concluded that infection of succeeding crops of foliage is initiated from these fallen leaves. However, sanitary practices involving destruction of infected leaves alone have not controlled the disease. It is thought that the conidia are produced on the outer cortex and buds but this has not been satisfactorily proven; also that these spores may remain on the outer cortex of the tree lodged in bark crevices sufficiently protected to remain viable through the leaf shedding period and until the new foliage develops. The definite source of infection is still unknown.

The mycelium upon entering the host is confined entirely to the space or area beneath the cuticle and above the epidermal cells of the leaves. The

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fungus stimulates the leaf cells, without immediately killing them, causing them to increase in number and size. This results in the formation of cups or pockets in the otherwise flat blade. Infections occur anywhere on either side of the leaf and cause a bulging or blister in the affected area. Usually the bulging side of the blister is on the upper surface of the leaf. The spores are produced in abundance on the concave sides of these blisters. They are scattered to the new foliage and rapidly cause infection over the entire tree. Since infection occurs only on immature foliage it is largely confined to the leaves which develop in the early spring from the dormant buds and those next produced on the new shoots. Infection is favored by cool, wet weather. Warm, dry weather may prevent infection entirely, even though the tree has been attacked previously for several years in succession. When infections are few on a single leaf it usually remains on the tree. If they are numerous and occur early in the expansion of the leaf it is usually shed.

Symptoms.—Early infection is indicated by the presence of barely visible specks on the upper surface of leaves, and is usually overlooked until it has developed enough to begin to cause a bulging of the leaf. The spots or blisters enlarge as the leaf expands and often reach their maximum size within a few days. The ultimate size and shape vary widely and seem to be closely connected with the age of the leaf when infection occurs. The older and more mature the leaf is when it becomes infected the smaller and more circular the blister.

The small circular blisters may become 1/16 of an inch in diameter, while the irregular ones may attain a maximum size of ¼ to ½ inch. The color of the blister is also variable with predominating blended shades of green, yellow, rose and purple. The brighter colors appear on the blisters of the younger foliage. The convex side of the spot is smooth and shows no sign of the fungus. The spores of the fungus are produced on the concave sides of the blisters and cause the surface to appear silver-gray. As the spores mature the spots appear brownish and velvety. This condition prevails until the leaf is shed or until the host cells are killed and turn dark brown. When the blisters are large or when they are located on principal veins, they often cause curling or distortions of the leaves of some of the narrow-leafed oaks.

Control.—Because of the wide distribution and large populations of diseased oaks in Florida the application of control methods for transplanted trees would be expensive. Only general recommendations can be made until more is learned about the fungus and the factors which influence its occurrence. Wherever small oak trees that are of particular value for shade or as specimen trees are seriously affected, sanitation should be practiced. All fallen foliage should be removed from the proximity of the tree and a fungicide such as 4-4-50 bordeaux mixture should be applied a week or 10 days before the buds begin to swell. Small trees can be easily sprayed but large trees require special equipment. The proper period for the application of fungicides for maximum efficiency is short. Possibly a second application may be of advantage in controlling the disease but it must be made before the leaves are fully expanded or the new growth begins to harden.